3021345

CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

25X1

SECRET/

25X1

COUNTRY	USSR (Leningrad Oblast)	REPORT NO.	
SUBJECT	Research on Rocket Fuels at the State Institute of Applied Chemistry	DATE DISTR.	25 February 1954
	25X1	NO. OF PAGES	8 25X1
DATE OF INFO.		REQUIREMENT NO.	
PLACE ACQUIRED		REFERENCES	

THE SOURCE EVALUATIONS IN THIS REPORT ARE DEFINITIVE.
THE APPRAISAL OF CONTENT IS TENTATIVE.
(FOR KEY SEE REVERSE)

25X1 1. The State Insitute of Applied Chemistry (Gosudarstvenniy Institut Prikladnoy Khimii) (GIPKh) was located in Leningrad in the Petrogradskaya Storona (quarter), on the north bank of the Malaya Neva River, which was formerly Vatnyy Island. The narrow branch of the river, which previously separated the island from the city, has been filled.

2. An alcohol plant was previously in the area now occupied by the State Institute. Prior to 1914 the Imperial Mint was located at that site. When Leningrad was besieged during World War II, ammunition was, allegedly, stored in the buildings of the Institute. As late as 1947 bombs were seen in the area of the Institute, which consisted of the main building containing a sizable number of laboratories and office rooms, a number of buildings with semi-technical testing facilities, the design bureau, and the control department. (See layout sketch of the Institute on page 5.)

3. The Institute was subordinate to the Ministry of Chemical Industry in Moscow. All designs made at the Institute had to be approved by this Ministry. The Soviet general manager of the Institute was Prokofyev (fnu); the chief engineer was Nugov (fnu). The engineer in charge of mechanical engineering and the construction of apparatus was called Ryabkov (fnu). In 1947, he was a member of the Soviet commission which selected the German Leuna experts to be deported to the USSR. The head designer of the Institute was Sklovskiy (fnu). He was frequently in Dzerzhinsk (N 56-15, E 43-24). A total of 1,500 persons were employed at the Institute. Technical personnel changed rather frequently. [redacted] chemists were rotated to the Institute for advanced training.

25X1 25X1

SECRET/

25X1

STATE	#x	ARMY	x	NAVY	x	AIR	x	FBI		AEC		OSI Ev	x	ATIC Ev	x

(Note: Washington Distribution Indicated By "X"; Field Distribution By "#".)

25X1 25X1

SECRET

4. A number of German specialists worked at the Institute between May 1947 and May 1951. Most of them were chemists, but the German group also included a graduate engineer and a precision mechanic charged with the mission of developing and maintaining measuring equipment required in the chemical laboratories. The precision mechanic worked in a special shop, while the chemical apparatus to be checked or repaired by the Germans was dismantled and installed by the Soviets. Approximately 90 per cent of the measuring sets were of German origin, the remainder of USA manufacture.

5. The Institute drew its electric current from the municipal electrical power supply of Leningrad. During the war a generator plant had been set up at the Institute. A turbine plant was connected to boiler house No. I. Water was drawn from the Neva River by a pumping station. A compressor plant used for the production of compressed air was attached to boiler house No. I. A refrigerator plant with a pipe system for the circulation of liquid cooling agents was also available. Carbonic acid, hydrogen, nitrogen, and other industrial gases were supplied from without.

6. Within the framework of the chemical research work done by the German experts, mainly nitromethane and nitrobutane were used for the production of nitro-alcohols. These agents were obtained by nitrating methane and butane with nitric acid or nitrogen dioxide in gaseous condition. Nitro-alcohols were then produced by the condensation of nitroparaffins with formaldehyde, acetaldehyde, propionic aldehyde, and other aldehydes in an alkaline medium. Thus, for instance, when nitromethane and formaldehyde were used, the chemical process developed according to the following formulas:

$CH_3NO_2 + HCHO \longrightarrow CH_2(NO_2).\ CH_2OH$ = ethylnitrate or

$CH_3NO_2 + HCHO \longrightarrow C(NO_2) - (CH_2OH)_3$ = 2-hydroxylmethyl-2-nitropropanediol

For nitromethane and acetaldehyde the corresponding formula is:

$CH_3NO_2 + CH_3CHO \longrightarrow CH_2(NO_2).\ CHOH.CH_3$ = nitropanol

For nitromethane and propionaldehyde the formula is:

$CH_3NO_2 + CH_3CH_2CHO \longrightarrow CH_2(NO_2).CHOH.CH_2CH_3$ = nitrobutanol

Nitrobutane and formaldehyde resulted in a compound with the formula:

$$CH_3CH_2\underset{\displaystyle NO_2}{\underset{|}{CH}}.CH_3 + HCHO \longrightarrow CH_3CH_2 - \overset{\displaystyle CH_2OH}{\overset{|}{\underset{\displaystyle NO_2}{\underset{|}{C}}}} - CH_3$$

The mixture of nitrobutane and other aldehydes led to reactions represented by the general formula:

$$CH_3CH_2\underset{\displaystyle NO_2}{\underset{|}{CH}}\cdot CH_3 + R\cdot CHO \longrightarrow CH\ CH - \overset{\displaystyle CHOH.R}{\overset{|}{\underset{\displaystyle NO_2}{\underset{|}{C}}}} - CH_3 \qquad 1.$$

Generally, the pertinent work was done using the method described by B.M. Vanderbilt and H.B. Haas in Industrial and Engineering Chemistry, issue No. 32, 1940, pages 34 to 38.

7. The process of reducing nitro-alcohols into the various amino-alcohols was carried out by means of Raney nickel used as a catalyst in an ethyl-alcohol solution, or by means of metallic iron in the presence of ferrous sulphate or sulphuric acid. For instance, two molecules of 2-nitro-2-ethyl-1.3-propanediol with iron dust and two molecules of phosphoric acid yielded 2-amino-2-ethyl-1.3-propanediol. The same result was obtained from two molecules of 2-nitro-2-ethyl-1.3-propanediol with iron dust + 2.3 molecules of acetic acid.

25X1

SECRET

8. Of the initial substances required for the synthetic production of amino-alcohols such as methylethanol amine and dimethylethanol amine, methylamine and dimethylamine were produced at the Institute, in a semi-technical pressure plant with the help of methanol, formaldehyde, and ammonia. Ethylene oxide and other intermediate products had to be furnished by an undetermined plant.

9. The condensation tests made for the conversion of amino-alcohols with the help of acetylene with a view to obtain vinyl ethers, iodine, zinc chloride, tin chloride, aluminum chloride, and iron chloride were used as catalysts, alkali being used as a condensing agent in order to avoid too turbulent reactions.

10, In the laboratory, dimethylethynyl carbinol was produced by condensing acetone acetylene with the help of potassium hydroxide or sodium amide in liquid ammonia. Dimethylethynyl carbinol has the structural formula:

$$\begin{matrix} CH_3 \searrow & & \\ & C - C \equiv CH & \\ CH_3 \nearrow & \searrow OH & \end{matrix}$$

i.e., the molecular formula C_5H_8O.

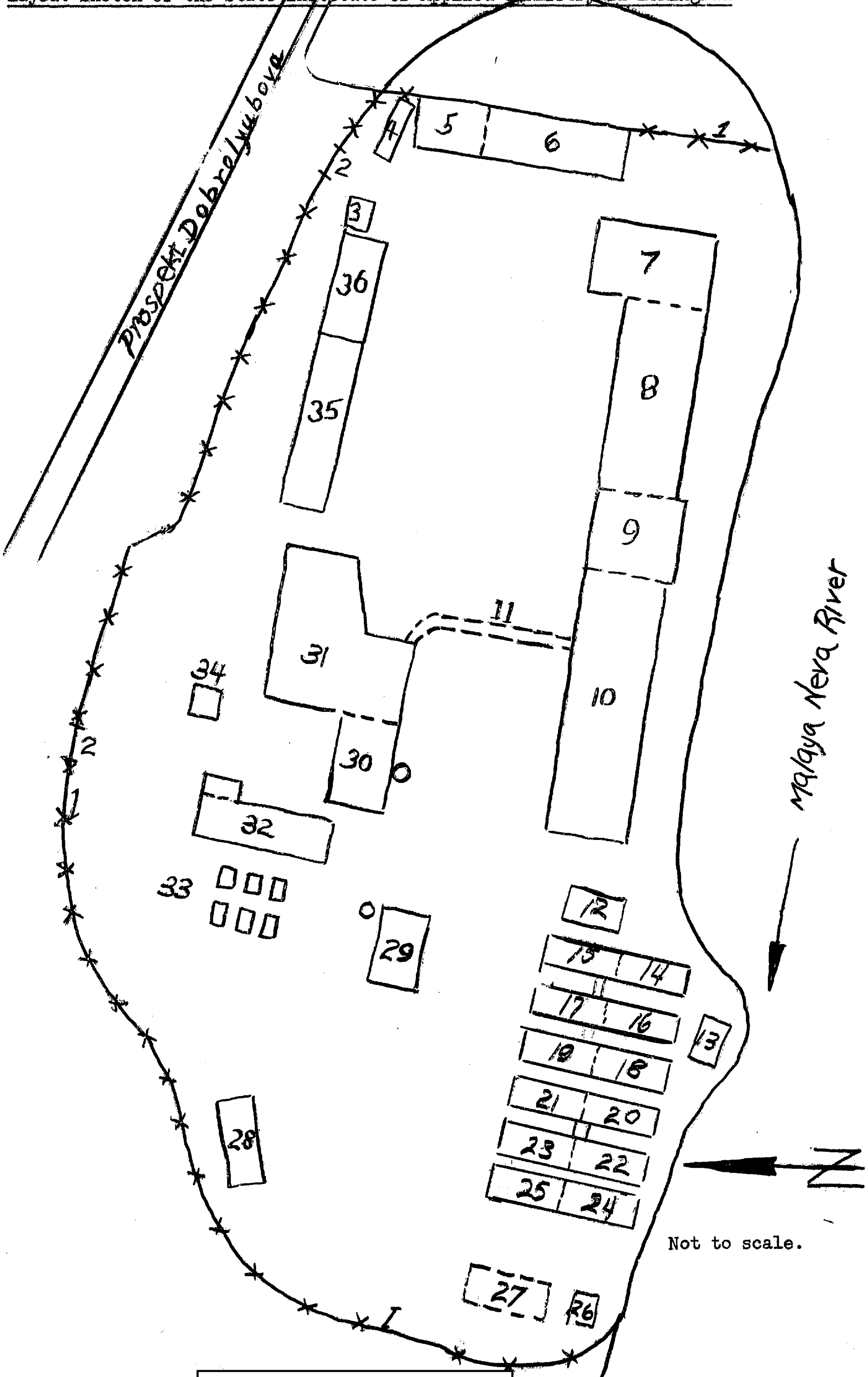
11. The catalytic decarbonylization of furfurol into furan was performed with the help of zinc-iron chromite catalysts, using US patent No. 2 374 149, Du Pont-Nemours, inventor G.M. Whitman, Claymont. The method of producing the catalysts as described in the patent was modified inasmuch as the zinc-iron chromite mixtures, during the refining process, were being kept at a temperature of 400° C for only one hour instead of the four hours prescribed in the patent. This modification brought about a slight soiling of the contact agents during the decarbonylization process through resins and oxygen, which again led to a prolonged catalytic surface activity.

12. The hydrogenation of furan into tetrahydrofuran was performed in liquid condition in the presence of a nickel contact at a pressure of 100 to 200 atmospheres in the conventional way. The splitting of tetrahydrofuran was performed either in fluid condition by heating tetrahydro with concentrated hydrochloric acid in silver autoclaves to a temperature of 180° C under a pressure of about 30 atmospheres, or in gaseous condition by conducting tetrahydrofuran in vaporous form and hydrogen chloride gas at temperatures of 200 to 300°C over aluminum oxide contacts. These experiments were interrupted in early May 1951 when the German experts returned to Germany.

13. The procedure applied for the development of oxygen adsorbing agents, the so-called chelates, was at first based on methods developed in the USA, among others, by R.H. Bailes, M. C. Calvin, and H.C. Diehl, and was published under the titles <u>Oxygen-Carrying Synthetic Chalte Compounds</u> or <u>Oxygen-Carrying Cobalt Compounds</u>. Schiff's base, used as an initial substance, was produced from salicyl aldehyde and ethylene diamine in an alcoholic solution. To one molecule of Schiff's base were added two molecules of potassium hydroxide in an aqueous solution, to which was then added a solution of one molecule of cobalt acetate plus one-half equivalent weight of sulphuric acid. The potash salt of Schiff's base together with the calculated quantity of cobalt acetate, in the course of the reaction, also formed potassium acetate; the latter substance partly reacted with the slight quantity of sulphuric acid. The pH value of the reaction mixture was fixed by a mixture of potassium acetate with free acetic acid at the ratio of approximately one molecule of potassium acetate to one molecule of acetic acid. The pH value obtained was five or six. The whole precipitation procedure had to be performed at boiling temperature.

14. As was indicated by the experiments of R.H. Bailes, M.C. Calvin, and H.C. Diehl, no regular connection between the structure of the chelates obtained and their properties could be determined in Leningrad. All the development work done in this field had a purely empirical character, and the theoretical problems were still largely unsolved. [redacted] 25X1 state in what direction the pertinent experiments were to be continued after the German experts had left for Germany.

Layout Sketch of the State Institute of Applied Chemistry in Leningrad



Not to scale.

25X1 25X1

SECRET

Layout of the State Institute of Applied Chemistry in Leningrad.

Legend:

1. Fence.

2. Gates.

3. Wooden building, check point for persons entering the installation.

4. Personnel office.

5. Dispensary.

6. Multi-story brick building with a flat gable roof. Buildings 5 and 6 cover an area of 70 x 12 meters. The ground floor of the brick building housed a kindergarten; the other floors were taken up by living quarters.

7-10. The main building, a three-story brick building, approximately 320 meters long. The different sections of the building were used as follows:

7. Office rooms.

8. Laboratories, including chemical-physical and electro-chemical laboratories and a lecture hall.

9. Reception rooms, library, office rooms, and a glass-blowing department.

10. Laboratories.

11. Passageway.

12. Low brick building, test plant. Work was done there with concentrated acids. The measuring sets used there showed signs of much corrosion.

13. Underground concrete bunker containing measuring stations. In 1948, new remote-controlled measuring sets were installed in two of the chambers. The equipment available there included a five-loop oscillograph and a six-loop oscillograph furnished by VEB Siemens in 1950.

14. Experimental plant USTA 579 (sic), which together with USTA 601 (sic)(item 15) was about 100 x 10 x 10 meters. USTA 579 was a high-pressure plant designed for a pressure of 300 atmospheres and a maximum temperature of 500°C. The equipment was dismantled at the Leuna plant. Plants of type USTA 579 were used at factories of the IG Farben concern for experiments with hydrogenation, dehydrogenation, and cracking procedures. USTA 579 was headed by one Yershov (fnu). Among other equipment, injection pumps with adjustable stroke for the pumping of ammonia, ethyl, and methyl alcohol into special reaction containers were available at the plant. The medium working pressure was 30 to 50 atmospheres at temperatures varying from 120 to 230°C. Mono-, di-, and tri-amines were obtained. The reaction containers formed six complete plants with electrical heating, to which two Hofer compressors with a capacity of 300 atmospheres pressure belonged. A Soviet named Hackelson (sic) was chief of this department.

15. USTA 601. The plant was built by the same engineer who designed USTA 579. Amines were produced there. Ammonia, ethyl alcohol, and acetylene were processed.

16. Laboratory for nitrating processes.

25X1

SECRET

25X1 25X1

SECRET/

17. Experimental plant with two reinforced concrete chambers. Experiments with methane gases and acids were made there. The plant was headed by one Kosyev (fnu), later by one Shpak (fnu), who previously had been technical manager of the Institute.

18. Department of undetermined character. Instruments for measuring temperatures of up to 200° C and pressures of up to five kg were installed. Panes of plexiglass were used for the windows of this building, because other types of glass became milky after a few hours. There was an odor of chlorine in the vicinity of the building, and fog continuously formed there.

19. Production of deep-cooling agents, allegedly called Friones. These agents were used for the liquefaction of rocket fuels. The lowest temperatures reached were - 40° C. The building was off-limits to the Germans employed at the Institute.

20. Locksmith shop, equipped with various types of grinding machines.

21. Lathe shop, equipped with about 30 long lathes and other machine tools; about 90 per cent of them were of German origin.

22. Deactivated shop, in which experiments with acetic acid were formerly made.

23. Electrolytic plant. Source observed a large transformer designed for 500 to 1,000 amperes. Low tension, about 10 volts. Workers employed there wore protective suits of felt. The containers in use there were, allegedly, of plastics.

24. Ruined building. It was scheduled to be reconstructed in 1951 as an experimental plant for work with furfurol.

25. Building destroyed in the war. An electric shop was provisionally installed there.

26. New building, construction on which was started in early 1951. The building was, allegedly, to house a testing plant for poisonous or explosive substances.

27. Destroyed building, about 70 x 10 meters. Work on its reconstruction was started in May 1951. According to rumors, it was to become a restaurant.

28. Brick building with a flat roof; storage of electrical equipment and a repair shop.

29. Boiler house No. II, a brick building, 20 x 15 meters; reconstructed in 1949/1950; sheet metal funnel about 35 meters high. The house was equipped with three tubular Siemens type boilers with a steam capacity of 16 tons per hour. Space for a fourth boiler was available. The boilers were fired by hand. Pipes extended from boiler house No. II to boiler house No. I.

30. Boiler house No. I, brick building, about 80 x 15 meters, equipped with three horizontal boilers and an old muffle furnace used for the heating of the room.

31. Catalyzing plant equipped with two centrifuges, large filtering presses, and electrically heated drying furnaces. The plant was reconstructed in May 1951. A fire truck of the Magirus type and other motorized fire-fighting equipment was parked in the building, which also housed the offices of the workers' council of the institute.

32. Brick building, 80 x 15 meters, with loading ramp used as storage for mechanical engineering equipment, such as flanges, valves, rubber hoses, high-pressure pipes, compressors, etc. All the equipment stored there had been dismantled in Germany.

33. Materials depot. Open-air storage and temporary storage buildings. Lubricating oil in drums was also observed there.

25X1

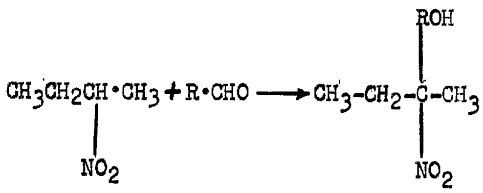
SECRET/

34. Acetylene plant.

35. Administration building, three-story brick building, housing design and other offices.

36. Multi-story brick building, control of measuring sets. The department was headed by one Velousov (fnu)? All measuring sets in use at the Institute were manufactured or checked by this department. Facilities for high-tension and low-tension currents, pressure testing, quantitative checks, measurements of temperatures, scales and apparatus for the performance of analyses were available. The mechanical equipment consisted of 20 lathes, five boring machines, besides milling and planing machines, powered saws, electric and autogenous welding sets, and spraying and painting equipment. The measuring equipment control department consisted of several sub-departments. Oscillographs were manufactured in the electronics sub-department, which was modernly equipped. The output was eight oscillographs per month. Measuring sets with controlled tubes for high-frequency operations were observed in the radio sub-department. The thermic sub-department was equipped with German measuring sets. At the Automatia (sic) sub-department temperature, pressure, and flow governors were manufactured. About 90 per cent of the equipment available had been dismantled at the Leuna plant.

25X1 Comment. This formula may have been garbled. Possibly it should read:



25X1 Comment. This name may be misspelled. Possibly it should be Belousov.